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Reliable Data Delivery for Dynamic Nodes in Adhoc Networks

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***Abstract*— To addresses the problem of delivering data packets for highly dynamic mobile ad hoc networks in a reliable and timely manner. Most existing ad hoc routing protocols are susceptible to node mobility, especially for large-scale networks. Driven by this issue, we propose an efficient Position-based Opportunistic Routing (POR) protocol which takes advantage of the stateless property of geographic routing and the broadcast nature of wireless medium. When a data packet is sent out, some of the neighbor nodes that have overheard the transmission will serve as forwarding candidates, and take turn to forward the packet if it is not relayed by the specific best forwarder within a certain period of time. By utilizing such in-the-air backup, communication is maintained without being interrupted. The additional latency incurred by local route recovery is greatly reduced and the duplicate relaying caused by packet reroute is also decreased. In the case of communication hole, a Virtual Destination-based Void Handling (VDVH) scheme is further proposed to work together with POR. Both theoretical analysis and simulation results show that POR achieves excellent performance even under high node mobility with acceptable overhead and the new void handling scheme also works well.**

***Index Terms*— Position-based Opportunistic Routing (POR) protocol, dynamic , Virtual Destination-based Void Handling (VDVH), broadcast.**

I. INTRODUCTION

A. WIRELESS NETWORK

Wireless networks are computer networks that are not connected by cables. It's utilized radio waves and/or microwaves to maintain communication channels between computers[1]. Telecommunications networks and installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations.

B. TYPES OF WIRELESS NETWORKS:

a) Wireless PAN:

Wireless personal area networks (WPANs) interconnect devices within a relatively small area, that is generally within a person's reach. For example, both Bluetooth radio and invisible infrared light provides a WPAN for interconnecting a headset to a laptop.

b) Wireless LAN:

A wireless local area network (WLAN) links two or more devices over a short distance using a wireless distribution method, usually providing a connection through an access point for Internet access. In this paper we use of spread-spectrum or OFDM technologies may allow users to move around within a local coverage area, and still remain connected to the network[1].

c) Wireless Mesh Network:

A wireless mesh network is a wireless network made up of radio nodes organized in a mesh topology. Each node forwards messages on behalf of the other nodes. Mesh networks can "selfheal", automatically re-routing around a node that has lost power

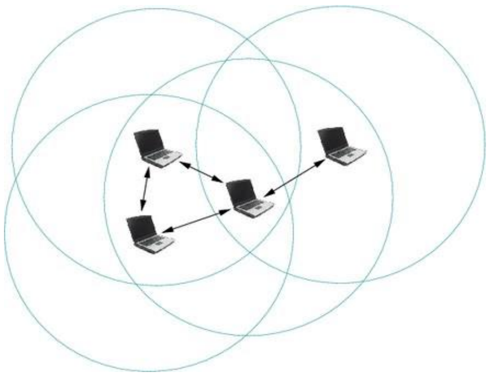

Fig:1.1 Adhoc Networks Structure

It's a decentralized type of network. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding the data[3].

II. LITERATURE SURVEY

The following are some of the papers reviewed to get an idea of the different systems existing in the relevant area. Position

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Based Routing for Wireless Mobile Ad Hoc Networks In mobile ad hoc network there are several routing algorithms, which utilize topology information to make routing decisions at each node. aim of this paper is to utilize position information to provide more reliable as well as efficient routing for certain applications. Thus extensions to existing position based routing algorithm have been described to work more efficiently even in cases where they are not working at present[2]. In this paper an algorithm is proposed, which removes some of the drawbacks of the existing GPSR (Greedy perimeter stateless routing) position based routing algorithm. In proposed algorithm different algorithm has been used to planarize the graph so that it will not disconnect the route in case of location inaccuracy in perimeter mode whereas in GPSR in certain cases of location inaccuracy it will disconnect the graph and hence the packets will not be routed thereby decreasing packet delivery ratio.

In the paper,the Geographic ad hoc networks use position information for routing. They often utilize stateless greedy forwarding and require the use of recovery algorithms when the greedy approach fails. We propose a novel idea based on virtual repositioning of nodes that allows to increase the efficiency of greedy routing and significantly increase the success of the recovery algorithm based on local information alone.

In the paper ,We explain the problem of predicting dead ends which the greedy algorithm may reach and bypassing voids in the network, and introduce NEAR, node elevation ad-hoc routing, a solution that incorporates both virtual positioning and routing algorithms that improve performance in ad-hoc networks containing voids. We demonstrate by simulations the advantages of our algorithm over other geographic ad-hoc routing solutions[2].
D. Chen and P. Varshney, “A Survey of Void Handling Techniques for Geographic Routing in Wireless Networks[4]

III. EXISTING SYSTEM

Mobile ad hoc networks (MANETs) have gained a great deal of attention because of its significant advantages brought about by multihop, infrastructure-less transmission.However, due to the error prone wireless channel and the dynamic network topology, reliable data delivery in MANETs, especially in challenged environments with high mobility remains an issue. Traditional topology-based MANET routing protocols (e.g., DSDV, AODV, DSR are quite susceptible to node mobility.

One of the main reasons is due to the predetermination of an end-to-end route before data transmission. Owing to the constantly and even fast changing network topology, it is very difficult to maintain a deterministic route.

The discovery and recovery procedures are also time and energy consuming. Once the path breaks, data packets will get lost or be delayed for a long time until the reconstruction of the route, causing transmission interruption.

DISADVANTAGES

- Geo-Graphic routing is a stateless protocol, so it is more sensitive to the node location information.
- GR is very sensitive to the inaccuracy of location information.
- If the node moves out of the sender’s coverage area, the transmission will fail.

- In the operation of greedy forwarding, the neighbour which is relatively far away from the sender is chosen as the next hop. If the node moves out of the sender’s coverage area, the transmission will fail.
- Communication Hole or Communication void is another major problem in the GPS technology. Communication void is a data corrupted state. Due to the data modification in the data packet flag communication void will occur in our communication.
- Recently, Another drawback of Greedy Forwarding Search is Sender Based Communication Strategy. Because sender is a static content, if we consider sender based communication means it will generate more problems in the communication network.

IV. PROPOSED SYSTEM

The position-based opportunistic routing mechanism which can be deployed without complex modification to MAC protocol and achieve multiple reception without losing the benefit of collision avoidance provided by 802.11.

The concept of in-the-air backup significantly enhances the robustness of the routing protocol and reduces the latency and duplicate forwarding caused by local route repair.

In the case of communication hole, we propose a Virtual Destination-based Void Handling (VDVH) scheme in which the advantages of greedy forwarding (e.g., large progress per hop) and opportunistic routing can still be achieved while handling communication voids.

Analyse the effect of node mobility on packet delivery and explain the improvement brought about by the participation of forwarding candidates.
The overhead of POR with focus on buffer usage and bandwidth consumption due to forwarding candidates’ duplicate relaying is also discussed. Through analysis, we conclude that due to the selection of forwarding area and the properly designed duplication limitation scheme, POR’s performance gain can be achieved at little overhead cost.
Finally, in this paper we evaluate the performance of POR through extensive simulations and verify that POR achieves excellent performance in the face of high node mobility while the overhead is acceptable.

ADVANTAGES IN PROPOSED SYSTEM

- Position based opportunistic routing mechanism which can be deployed without complex modification to MAC protocol and achieve multiple receptions without losing the benefit of collision avoidance.
- Opportunistic routing can still be achieved while handling communication voids.

V. IMPLEMENTATION ISSUES

5.1 PROBLEM DEFINITION (POSITION-BASED OPPORTUNISTIC ROUTING):

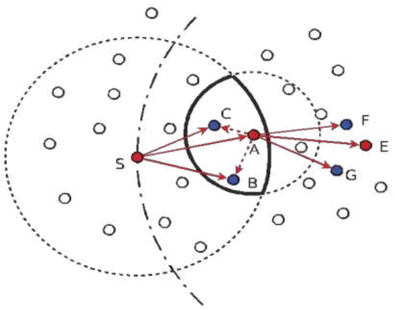

Fig 5.1: The operation of POR in normal situation

The design of POR is based on geographic routing and opportunistic forwarding. The nodes are assumed to be aware of their own location and the positions of their direct neighbours. Neighbourhood location information can be exchanged using one-hop beacon or piggyback in the data packet's header. While for the position of the destination, assume that a location registration and lookup service which maps node addresses to locations is available It could be realized using many kinds of location service. Some efficient and reliable way is also available. the location of the destination could be transmitted by low bit rate but long range radios, which can be implemented as periodic beacon, as well as by replies when requested by the source. When a source node wants to transmit a packet, it gets the location of the destination first and then attaches it to the packet header[4].

Due to the destination node's movement, the multichip path may diverge from the true location of the final destination and a packet would be dropped even if it has already been delivered into the neighbourhood of the destination. To deal with such issue, additional check for the destination node is introduced. At each hop, the node that forwards the packet will check its neighbour list to see whether the destination is within its transmission range. If yes, the packet will be directly forwarded to the destination, similar to the destination location prediction scheme described in . By performing such identification check before greedy forwarding based on location information, the effect of the path divergence can be very much alleviated.

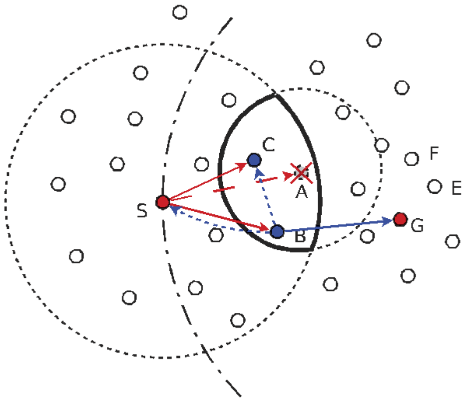

Fig 5.2: The operation of POR when the next hop fails to receive the packet

In conventional opportunistic forwarding, to have a packet received by multiple candidates, either IP broadcast or an integration of routing and MAC protocol is adopted. The former is susceptible to MAC collision because of the lack of collision avoidance support for broadcast packet in current 802.11, while the latter requires complex coordination and is not easy to be implemented. In POR, scheme as the MAC multicast mode described in. The packet is transmitted as unicast (the best forwarder which makes the largest positive progress toward the destination is set as the next hop) in IP layer and multiple reception is achieved using MAC interception. The use of RTS/CTS/DATA/ACK significantly reduces the collision and all the nodes within the transmission range of the sender can eavesdrop on the packet successfully with higher probability due to medium reservation.As the data packets are transmitted in a multicast-like form, each of them is identified with a unique tuple (src_ip, seq_no) where src_ip is the IP address of the source node and seq_no is the corresponding sequence number. Every node maintains a monotonically increasing sequence number, and an ID_Cache to record the ID (src_ip, seq_no) of the packets that have been recently received. If a packet with the same ID is received again, it will be discarded. Otherwise, it will be forwarded at once if the receiver is the next hop, or cached in a Packet List if it is received by a forwarding candidate, or dropped if the receiver is not specified. The packet in the Packet List will be sent out after waiting for a certain number of time slots or discarded if the same packet is received again during the waiting period (this implicitly means a better forwarder has already carried out the task)[5].

The basic routing scenario of POR can be simply illustrated. In normal situation without link break, the packet is forwarded by the next hop node (e.g., nodes A, E) and the forwarding candidates (e.g., nodes B, C; nodes F, G) will be suppressed (i.e., the same packet in the Packet List will be dropped) by the next hop node's transmission. In case node A fails to deliver the packet (e.g.,node A has moved out and cannot receive the packet), node B, the forwarding candidate with the highest priority, will relay the packet and suppress the lower priority candidate's forwarding (e.g., node C) as well as node S. By using the feedback from MAC layer, node S will remove node A from the neighbor list and select a new next hop node for the subsequent packets. The packets in the interface queue taking node A as the next hop will be given a second chance to reroute. For the packet pulled back from the MAC layer, it will not be rerouted as long as node S overhears node B's forwarding[6].

One of the key problems in POR is the selection and prioritization of forwarding candidates. Only the nodes located in the forwarding area would get the chance to be backup nodes. The forwarding area is determined by the sender and the next hop node. A node located in the forwarding area satisfies the following two conditions: 1) it makes positive progress toward the destination; and 2) its distance to the next hop node should not exceed half of the transmission range of a wireless node (i.e., R=2) so that ideally all the forwarding candidates can hear from one another. In Fig. the area enclosed by the bold curve is defined as the forwarding area. The nodes in this area, besides node A (i.e., nodes B, C), are potential candidates. According to the required number of backup nodes, some (maybe all) of them will be selected as forwarding candidates. The priority of a forwarding candidate is decided by its distance to the destination. The nearer it is to the destination, the higher priority it will get. When a node sends or forwards a packet, it selects the next hop forwarder as well as the forwarding candidates among its neighbors. The next hop and the candidate list comprise the forwarder list. The procedure to select and prioritize the forwarder list. The candidate list will be attached to the packet header and updated hop by hop.

Only the nodes specified in the candidate list will act as forwarding candidates. The lower the index of the node in the candidate list, the higher priority it has. Every node maintains a forwarding table for the packets of each flow (identified as source-destination pair) that ithas sent or forwarded. Before calculating a new forwarder list, it looks up the forwarding table, an example is illustrated in Table 1, to check if a valid item for that destination is still available. The forwarding table is constructed during data packet transmissions and its maintenance is much easier than a routing table. It can be seen as a trade-off between efficiency and scalability. As the establishment of the forwarding table only depends on local information, it takes much less time to be constructed. Therefore, we can set an expire time on the items maintained to keep the table relatively small. In otherwords, the table records only the current active flows, while in conventional protocols, a decrease in the route expire time would require far more resources to rebuild.

VI. CONCLUSION

We address the problem of reliable data delivery in highly dynamic mobile ad hoc networks. Constantly changing network topology makes conventional ad hoc routing protocols incapable of providing satisfactory performance. In the face of frequent link break due to node mobility, substantial data packets would either get lost, or experience long latency before restoration of connectivity. Inspired by opportunistic routing, we propose a novel MANET routing protocol POR which takes advantage of the stateless property of geographic routing and broadcast nature of wireless medium. Besides selecting the next hop, several forwarding candidates are also explicitly specified in case of link break. Leveraging on such natural backup in the air, broken route can be recovered in a timely manner. The efficacy of the involvement of forwarding candidates against node mobility, as well as the overhead due to opportunistic forwarding is analyzed. Through simulation, we further confirm the effectiveness and efficiency of POR: high packet delivery ratio is achieved while the delay and duplication are the lowest.

On the other hand, inherited from geographic routing, the problem of communication void is also investigated. To work with the multicast forwarding style, a virtual destination-based void handling scheme is proposed. By temporarily adjusting the direction of data flow, theadvantage of greedy forwarding as well as the robustness brought about by opportunistic routing can still be achieved when handling communication voids.

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